

**Final
Limited Site Investigation Report
for
Radiological Contamination
at the
Former Scioto Ordnance Plant
Marion, Ohio**

Prepared for:

U.S. Army Corps of Engineers
Nashville District
Nashville, Tennessee 37202

under Contract No. DACW62-94-D-0011
Delivery Order No. 0003

Prepared by:

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October 1995

Limited Site Investigation
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SECTION 1.0 - EXECUTIVE SUMMARY

The objective of this limited site investigation (SI) was to determine if there is gross evidence of radiological contamination within the former Monsanto Warehouse Building, including the area around the exits to the Monsanto structures, and Likins Chapel basement area. The results at the time of this study would indicate that gross radiological contamination is not present within the Monsanto Building and Likins Chapel basement area.

The former Scioto Ordnance Plant was used for the production of fuzes, boosters, ammunition, and bombs. In August 1945, WWII ended, and the Scioto Ordnance Plant operations were subsequently terminated. In April 1949, the Atomic Energy Commission (AEC) took over 5.2 square kilometers of land (1,285 acres as defined by the Archives Search Report). Under the AEC, the former Monsanto Building was believed to be used to store, manufacture or perform research on radioactive materials. Warner Warehousing has owned the Monsanto Building since 1970 and is currently using the former Monsanto Building as a storage warehouse. The Likins Chapel basement area was suspected of being used to store radioactive materials for use at the former Scioto Ordnance Plant.

The radiation surveys for the Monsanto Building and Likins Chapel were conducted in two phases. In the first phase, the surveys were performed during the initial walk-through of the facility and the surrounding grounds outside the facility. The second phase of the surveys was based on the systematic approach. The objective was to systematically survey the rooms in order to characterize (to the extent possible) the levels, and to identify the exact locations of any detected radioactive contamination in the facility. In addition to the radiological surveys, three water samples were collected from the basement of the former Monsanto Building. These samples were collected at the bottom of the three accessible stairways. Water samples were analyzed for gross alpha, gross beta, isotopic uranium, and a beta/gamma scan.

The results of the limited SI survey and sampling activities identified no areas of gross radiological contamination. The radiological contamination survey results identified no readings above 100 counts per minute for alpha nor beta/gamma. The water sample analytical results included: Gross Alpha data were all below a 3.1 pCi/L concentration, while the Drinking Water Standard is 15 pCi/L; Gross Beta information indicated a level of approximately 30 pCi/L, while the Drinking Water Standard is at 50 pCi/L; Isotopic Uranium levels were all less than 1 pCi/L; and Gamma Activity Scans did not identify any isotopic activity above the Minimum Detectable Level (MDL), with the exception of one sample's potassium-40 activity at 158 +/- 106 pCi/L. Potassium-40 is a naturally occurring isotope, and the level observed is not unusual.

SECTION 2.0 - GENERAL

2.1 - Introduction

This limited Site Investigation (SI) Report for the former Monsanto Building and Likins Chapel was prepared by Science Applications International Corporation for the U.S. Army Corps of Engineers Nashville District in accordance with the Statement of Work (SOW) under contract DACW62-94-D-0011, Delivery Order Number 0003.

2.2 - Project Objectives

The objective of this limited SI is to determine if there is radiological contamination within the former Monsanto Warehouse Building, including the area around the exits from the Monsanto structures, and Likins Chapel basement area. In addition, if contamination is identified, another objective is to provide recommendations for any necessary follow-up investigations or removal activities at these sites.

2.3 - Site Location and Physiography

2.3.1 - Monsanto Building

The former plant is located two kilometers northeast of Marion, Ohio, and is bordered on the west by the Pennsylvania Railroad, on the east by State Route 98, on the south by Fairground Road and the Erie Railroad, and on the north by Marseilles-Galion Road. The former Monsanto Building was believed to be used to store, manufacture or perform research on radioactive materials.

The Monsanto Building is a large warehouse type structure with two floors and a basement (see Figure 1). The building is not heated and has limited electric power available. The building is constructed mainly of concrete with massive concrete pillars and floors. The main floor is mostly open with five adjoining rooms in the center of the building and at least three small vault-like rooms at various locations. The five adjoining rooms have ceilings extending to the roof, and four of the rooms have observation areas. In each of these four rooms, one of the walls is lined with what appeared to be glove boxes.

The upper floor is mostly an open area. One room was found that consisted of a tiled bath which was approximately 3.3 meters wide by 8.1 meters long and 2.85 meters deep. Another area of the upper floor had observation windows, various control devices, and overlooked one of the five rooms on the main floor. Extreme caution was used in investigating the upper floor because the roof was collapsed in areas, and the floor was covered with ice. Pigeons were nesting in the roof rafters, and pigeon droppings were present throughout.

The basement was not investigated because it was flooded. Three stairways were located leading into the basement, and a fourth stairway was identified but was inaccessible. It was not obvious from visual inspection how many stairways accessed the upper floor.

2.3.2 - Likins Chapel

Likins Chapel is currently being used as a residential rental property and is approximately 2.5 kilometers northeast of Marion, Ohio. The Likins Chapel is located in a residential area on Likins Chapel Road. The basement area of the Likins Chapel was believed to have been used to store radioactive materials.

2.4 - Ownership and Prior Use

2.4.1 - Monsanto Building

The ordnance plant previously included approximately 50 square kilometers of what was mostly farm land. The Department of Defense (DOD) used this plant for the production of fuzes, boosters, ammunition, and bombs. In August 1945, WWII ended and the Scioto Ordnance Plant operations were subsequently terminated. The U.S. Government distributed some of the property back to the public. In April 1949, the Atomic Energy Commission (AEC) took over 5.2 square kilometers of land (1,285 acres as defined by the Archives Search Report). Under the AEC, the former Monsanto Building was believed to be used to store, manufacture or perform research on radioactive materials. Warner Warehousing has owned the Monsanto Building since 1970. The warehouse building is owned by Gary Warner and is currently used as a storage warehouse.

2.4.2 - Likins Chapel

The Likins Chapel building is currently owned by Judith Postell. The building was once a church but is now being used as a residential rental property. The building was unoccupied during the survey.

2.5 - Previous Studies

The Project Review Fact Sheet dated January 30, 1995, for the Formerly Utilized Defense Sites Program indicated that the Preliminary Assessment and Archive Search Report identified that there is a potential for radiological waste contamination at the former Monsanto Building at the former Scioto Ordnance Plant and at the Likins Chapel.

SECTION 3.0 - SITE INVESTIGATION

3.1 - Introduction

This section describes the SI field investigation and sampling program conducted at the former Scioto Ordnance Plant Monsanto Building and at Likins Chapel. The Field Investigations for the two sites under consideration are described separately. The water samples obtained from the former Monsanto Building were the only samples obtained for this SI.

3.2 - Field Investigations

3.2.1 - Monsanto Building

The radiation surveys for the Monsanto Building were conducted in two phases. Health and safety concerns, including building restrictions and associated dangers, were discussed prior to entering the warehouse. A Site Safety and Health Plan was prepared for this SI and is provided in Appendix B.

In the first phase, the surveys were performed during the initial walk-through of the facility and the surrounding grounds outside the facility. The walk-through was conducted to allow the survey personnel to gain familiarity with the lay-out of the building and the location of physical structures of interest (such as the rooms, vaults, and stairs to the upper floor and basement). The first phase surveys were performed to check for the existence of contamination in the building and were intended to serve as a gauge for the levels of contamination present. Two Ludlum Model 3 radiological meters with a Ludlum Model 43-5 alpha probe and Ludlum Model 44-9 beta/gamma probe were used during this walk-through. Calibration sheets for the Ludlum meters and probes are provided in Appendix C. During the walk-through, beta/gamma and alpha surveys were performed using the observational approach to check various "suspect" locations and physical features in the building for radioactive contamination. The physical features surveyed included the walls and floors in the rooms and vaults, piping drains, cracks and holes in the flooring material, and doors to the stairwells. The locations within the facility surveyed, using the observational approach, were the rooms and areas immediately outside the rooms, the vaults, stairwell access areas, and the ledge around the tiled pool (located on the upper floor). Extreme caution was used in investigating the upper floor because the roof was collapsed in areas, and the floor was covered with ice. Pigeons were nesting in the roof rafters, and pigeon droppings were present throughout.

Exterior locations surveyed included the cooling tower behind the facility, the smoke stack, and the entrances to the facility. These surveys consisted of checking the bottom regions of the wooden cooling tower structure and its catchment basin, the bricks around the access door to the smokestack, as well as debris in the stack itself.

The second phase of the surveys was based on the systematic approach. The objective here was to systematically survey the rooms in order to characterize (to the extent possible) the levels, and to

identify the exact locations of any detected radioactive contamination in the facility. The rooms were surveyed in this rigorous manner since it was deemed that they were the most likely places where radioactive contamination would be found. Systematic surveys were not performed for other locations within and without the facility since the observational surveys failed to identify the presence of contamination. In the systematic survey, beta/gamma and alpha readings were taken at intervals of approximately one meter. The floors and walls (up to about two meters) were surveyed. Additional surveys were made at suspect locations, such as floor drains, holes for piping in the walls, cracks in the floors and walls, recesses in the walls, and unusual physical features. Note that rooms 1 and 2 could not be fully surveyed due to items being stored within these storage areas. However, based on the survey results, this was not considered to be a concern.

3.2.2 - Likins Chapel

A walk-through of the main floor and basement of the Likins Chapel building was initially conducted. This walk-through was led by the present owner of Likins Chapel. Features such as room additions in the basement and the carpeting over the basement floor were noted. Apparently, the basement was renovated in the last three years and was converted into an apartment, complete with a small kitchen and bathroom.

A radiation survey was performed to check for the existence of radioactive contamination. Two Ludlum Model 3 Ratemeters with a Ludlum Model 43-5 alpha probe and Ludlum Model 44-9 beta/gamma probe were used to perform the survey. The calibration sheets for the Ludlum meters and probes are provided in Appendix C.

A beta/gamma survey was performed first. Systematic measurements were made at approximately one-foot intervals along the floor/wall joint (along the baseboards) in the basement. Random readings were taken at the entrance to the basement, on the floor, on the walls, along the window sills, and door knobs. The rooms in the basement, including the kitchen, bathroom, and closets, were surveyed.

Next, an alpha survey was performed. This survey was conducted in a manner similar to the beta/gamma survey. It should be noted, however, that alpha surveys of carpeted areas are usually ineffective due to the attenuative effects of the carpet material. The carpet in the basement is glued to the floor. Thus, it was not possible to perform alpha surveys under the carpet.

A few random beta/gamma and alpha surveys were then made upstairs, in the main floor of the chapel. The floor is made of wood. The clutter of old furniture and debris made a systematic survey impractical.

3.3 - Sampling Program

A total of three water samples were collected from the basement of the former Monsanto Building. These samples were collected at the bottom of the three accessible stairways. A layer of ice had formed on top of the water which had to be broken in order to collect the samples. Each sample consisted of 4 one-liter plastic bottles. At each location, a clean one-liter bottle was submerged into the water and used to fill the four sample bottles. Sample bottles were preserved with nitric acid. Sample labels and custody seals were attached to each sample bottle and a chain of custody form was completed for shipment of samples to the laboratory.

The analytical laboratory used on this task was PACE located in Golden, Colorado. Samples were analyzed for gross alpha, gross beta, isotopic uranium, and a beta/gamma scan was conducted. Three copies of the sample analytical results were provided to Walter Green, USACE Nashville on March 30, 1995. The analytical results are also provided in Appendix A.

SECTION 4.0 - ANALYTICAL RESULTS

4.1 - Introduction

This section provides a discussion of the analytical results obtained during this SI of the former Monsanto Building and Likins Chapel.

4.2 - Results of Sampling

The radiochemical results for the water samples collected on February 17, 1995, were submitted to the USACE Nashville District on March 30, 1995, and are provided in Appendix A. The analyses indicate activity levels at or below normal background.

4.3 - Quality Control Results

The Quality Control results including a laboratory method blank, a sample duplicate analysis, a laboratory control sample analysis, and matrix spike/matrix spike duplicate determinations are provided in Appendix A. All QC data were within acceptable ranges for the analysis performed.

4.4 - Site Drawing/Map and Positive Hits Table

A building diagram of the Monsanto Building investigated as part of this SI is provided as Figure 1. There were no analytical sample results or radiological contamination survey results observed above the defined action levels; therefore, a "positive hits table" has not been provided. A building drawing of the Likins Chapel basement area is provided in Figure 2.

4.5 - Comparison of Analytical Results to Action Levels

4.5.1 - Radiological Contamination Survey

The Monsanto Building's first phase surveys were performed to check for the existence of contamination in the building and were intended to serve as a gauge for the levels of contamination present. No readings were observed above 100 counts per minute, well below the proposed Action Levels. The physical features surveyed included the walls and floors in the rooms and vaults, piping drains, cracks and holes in the flooring material, and doors to the stairwells. The locations within the facility surveyed using the observational approach were the rooms and areas immediately outside the rooms, the vaults, stairwell access areas, and the ledge around the tiled pool (located on the upper floor). The exterior locations surveyed included the cooling tower behind the facility, the smoke stack, and the entrances to the facility. These surveys consisted of checking the bottom regions of the wooden cooling tower structure and its catchment basin, the bricks around the access door to the smokestack, as well as debris in the stack itself.

The second phase of the Monsanto Building survey was based on the systematic approach. The objective here was to systematically survey the rooms in order to characterize (to the extent possible) the levels, and to identify the exact locations of any detected radioactive contamination in the facility. The rooms were surveyed in this rigorous manner since it was deemed that they were the most likely places where radioactive contamination would be found. Systematic surveys were not performed for other locations within and without the facility since the observational surveys failed to identify the presence of contamination. In the systematic survey, beta/gamma and alpha readings were taken at intervals of approximately one meter. The floors and walls (up to about two meters) were surveyed. Additional surveys were made at suspect locations, such as floor drains, holes for piping in the walls, cracks in the floors and walls, recesses in the walls, and unusual physical features. No readings were observed above 100 counts per minute, well below the proposed Action Levels. Note that rooms 1 and 2 could not be fully surveyed due to items being stored within these areas.

Beta/gamma and alpha radiation surveys were performed at Likins Chapel to check for the existence of radioactive contamination and to measure the levels of any contamination that might be present. No readings were observed above 100 counts per minute, well below the proposed Action Levels. In the basement of Likins Chapel, surveys were made along the wall/floor joints, at the entrance, on the walls, and along window sills. The door knobs on the doors to the rooms in the basement were checked as well. Several random surveys were made in the upstairs (main floor) of the chapel.

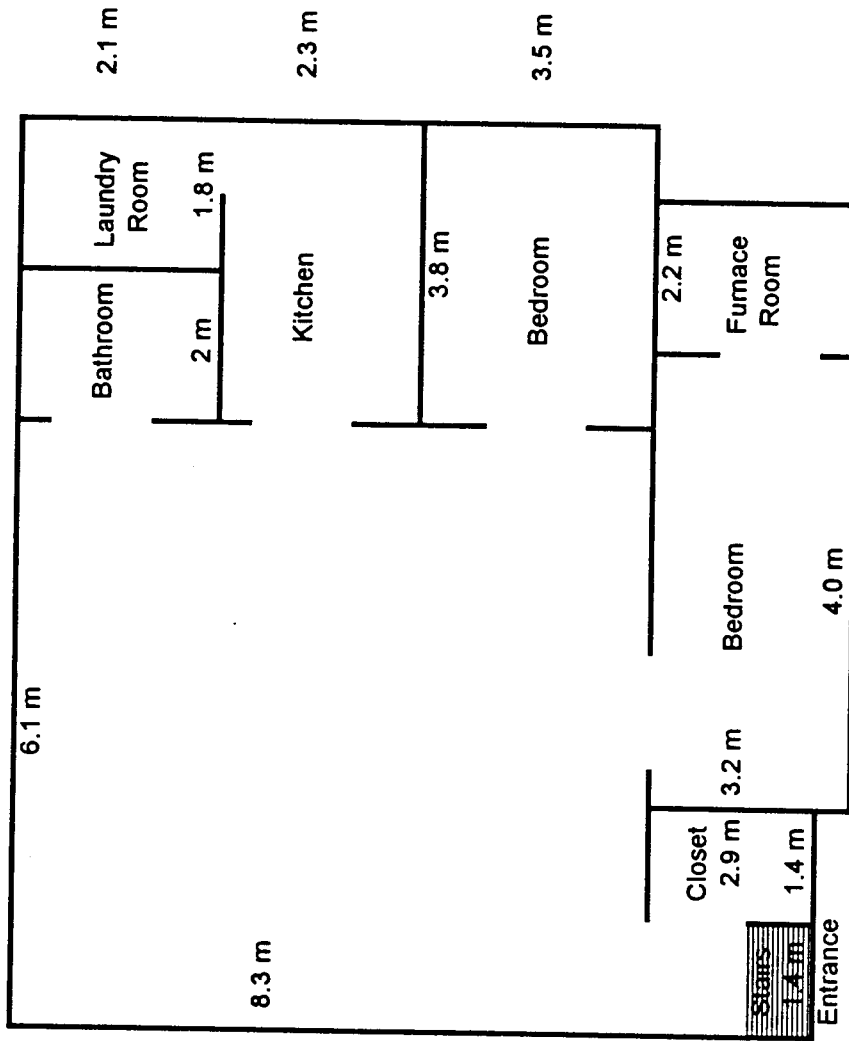
4.5.2 - Analytical Results

The Gross Alpha data were all below a 3.1 pCi/L concentration, while the Drinking Water Standard is 15 pCi/L. Gross Beta information indicates a level of approximately 30 pCi/L, while the Drinking Water Standard is at 50 pCi/L. Isotopic Uranium levels were all less than 1 pCi/L. Gamma Activity Scans did not identify any isotopic activity above the Minimum Detectable Level (MDL), with the exception of one sample's potassium-40 activity at 158 +/- 106 pCi/L. Potassium-40 is a naturally occurring isotope, and the level observed is not unusual.

SECTION 5.0 - CONCLUSIONS AND RECOMMENDATIONS

The objective of this SI was to determine if there is radiological contamination within the former Monsanto Warehouse Building, including the area around the exits from these structures, and Likins Chapel. In addition, if contamination was identified, another objective would be to provide recommendations for any necessary follow-up investigations or removal activities at these sites.

The results of the SI survey and sampling indicate there were no observable gross areas of radiological contamination noted at the Monsanto Building and the Likins Chapel. The radiological contamination survey results provided no observed readings above 100 counts per minute for alpha and beta/gamma. The water sample analytical results were below the associated action levels. The results of this study indicate that gross radiological contamination of the Monsanto Building and Likins Chapel is not present and, therefore, no further action is recommended.



LIKINS CHAPEL - BASEMENT

Location: Marion, Ohio

Date: 8/11/95

Scale: Not to scale

Figure 2 - Likins Chapel Floor Diagram.

Appendix A

Scioto Ordnance Radiochemical Data



Science Applications International Corporation
An Employee-Owned Company

331.950330.004

March 30, 1995

U.S. Army Engineer District
Nashville District
CEORN-ER-M (Walter Green)
Post Office Box 1070
Nashville, Tennessee 37202-1070

Reference: Contract DACW62-94-D-0011; Delivery Order 0003

Subject: Scioto Ordnance Radiochemical Data

Dear Mr. Green:

Enclosed with this correspondence is three (3) copies of the Scioto Ordnance Radiochemical Data and a brief description of the analytical results and laboratory quality control results. Please contact me at (615) 481-8786 if there are any questions. SAIC looks forward to the continuing opportunity of working with the Nashville District on this project.

Sincerely,

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

A handwritten signature in black ink, reading "Robert J. Milazzo". The signature is written in a cursive style with a large, stylized "M" and "Z".

Robert J. Milazzo
Project Manager

Enclosure


800 Oak Ridge Turnpike, P.O. Box 2502, Oak Ridge, Tennessee 37831 (615) 481-4600

Other SAIC Offices: Albuquerque, Boston, Colorado Springs, Dayton, Huntsville, Las Vegas, Los Angeles, McLean, Orlando, Palo Alto, San Diego, Seattle, Tucson

MEMORANDUM

Date: March 17, 1995

To: Bob Milazzo

From: Nile Luedtke 

Subject: Scioto Ordnance Radiochemical Data

The attached data tables present the radiochemical results for the Scioto Ordnance water samples collected on February 17, 1995. Analysis performed included Gross Alpha, Gross Beta, Uranium Isotopic, and Gamma Activity Scans. None of the data is extraordinary, all analysis indicate activity levels at or below normal background levels.

Gross Alpha data were all below a 3.1 pCi/L concentration, while the Drinking Water Standard is at 15 pCi/L. Gross Beta information indicates a level of approximately 30 pCi/L, while the Drinking Water Standard is at 50 pCi/L. Isotopic Uranium levels were all less than 1 pCi/L. Gamma Activity Scans did not identify any isotopic activity above the Minimum Detectable Level (MDL), with the exception of one sample's potassium-40 activity at 158 ± 106 pCi/L. Potassium-40 is a naturally occurring isotope and the level observed is not unusual.

Laboratory quality control information is also attached. This includes the laboratory method blank, a sample duplicate analysis, a laboratory control sample analysis, and matrix spike/matrix spike duplicate determinations. All QC data were within acceptable ranges for the analysis performed.

If any additional information or report documentation is required for this work, please contact me.

SCIOTO ORDNANCE

RADIOCHEMICAL ANALYSES

REPORT OF LABORATORY ANALYSIS

SAIC
800 Oak Ridge Turnpike
Oak Ridge, TN 37830

March 03, 1995
PACE Project Number: D50218501

Attn: Mr. Niel Ludtke

Client Reference: Scioto Ordnance

PACE Sample Number:
Date Collected:
Time Collected:
Date Received:

65 0024407
02/17/95
12:00
02/18/95
SCIOTO 001

Parameter	Units	MDL	METHOD	DATE ANALYZED
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INORGANIC ANALYSIS

GROSS ALPHA AND BETA

Alpha, Gross	pCi/L	3.0	ND	EPA 900.1	03/02/95
Beta, Gross	pCi/L	7.0	29+-5.7		03/02/95

GAMMA SCAN

Sodium-22	pCi/L	2.2	ND	EPA 901.1	02/27/95
Potassium-40	pCi/L	130	ND		02/27/95
Manganese-54	pCi/L	19	ND		02/27/95
Cobalt-58	pCi/L	16	ND		02/27/95
Iron 59	pCi/L	41	ND		02/27/95
Cobalt-60	pCi/L	25	ND		02/27/95

Zinc-65	pCi/L	50	ND		02/27/95
Strontium-85	pCi/L	23	ND		02/27/95
Ruthenium-103	pCi/L	19	ND		02/27/95
Antimony-124	pCi/L	16	ND		02/27/95
Iodine-129	pCi/L	NC	NC		02/27/95
Iodine-131	pCi/L	28	ND		02/27/95

Barium-133	pCi/L	19	ND		02/27/95
Cesium-134	pCi/L	16	ND		02/27/95
Cesium-137	pCi/L	21	ND		02/27/95
Cesium-141	pCi/L	24	ND		02/27/95
Europium-152	pCi/L	41	ND		02/27/95
Europium-154	pCi/L	45	ND		02/27/95

Europium-155	pCi/L	52	ND		02/27/95
Bismuth-207	pCi/L	13	ND		02/27/95
Thallium-208	pCi/L	51	ND		02/27/95
Lead-210	pCi/L	2600	ND		02/27/95
Bismuth-210	pCi/L	15	ND		02/27/95
Lead-212	pCi/L	23	ND		02/27/95

Lead-214	pCi/L	25	ND		02/27/95
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REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
Page 2

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

PACE Sample Number:
Date Collected:
Time Collected:
Date Received:
Client Sample ID:

65 0024407
02/17/95
12:00
02/18/95
SCIOTO 001

<u>Parameter</u>	<u>Units</u>	<u>MDI</u>	<u>METHOD</u>	<u>DATE ANALYZED</u>
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INORGANIC ANALYSIS

GAMMA SCAN

Bismuth-214	pCi/L	34	ND	EPA 901.1	02/27/95
Thorium-227	pCi/L	130	ND		02/27/95
Actinium-228	pCi/L	86	ND		02/27/95
Thorium-234	pCi/L	1100	ND		02/27/95
Protactinium-234	pCi/L	2400	ND		02/27/95

ISOTOPIC URANIUM

Uranium 234	pCi/L	0.70	ND		03/01/95
Uranium 235	pCi/L	0.53	ND		03/01/95
Uranium 238	pCi/L	0.47	ND		03/01/95

Mr. Niel Ludtke
Page 3

March 03, 1995
PACE Project Number: D5021850

Client Reference: Scioto Ordnance

PACE Sample Number:
Date Collected:
Time Collected:
Date Received:
Client Sample ID:
Parameter

65 0024415
02/17/95
12:15
02/18/95
SCIOTO 002

Units MDL METHOD DATE ANALYZED

INORGANIC ANALYSIS

GROSS ALPHA AND BETA

Alpha, Gross	pCi/L	3.1	ND	EPA 900.1	03/02/95
Beta, Gross	pCi/L	6.4	26+-5.1		03/02/95

GAMMA SCAN

Sodium-22	pCi/L	19	ND	EPA 901.1	02/27/95
Potassium-40	pCi/L	80	158+-106		02/27/95
Manganese-54	pCi/L	22	ND		02/27/95
Cobalt-58	pCi/L	19	ND		02/27/95
Iron 59	pCi/L	48	ND		02/27/95
Cobalt-60	pCi/L	25	ND		02/27/95

Zinc-65	pCi/L	37	ND		02/27/95
Strontium-85	pCi/L	23	ND		02/27/95
Ruthenium-103	pCi/L	17	ND		02/27/95
Antimony-124	pCi/L	12	ND		02/27/95
Iodine-129	pCi/L	NC	NC		02/27/95
Iodine-131	pCi/L	31	ND		02/27/95

Barium-133	pCi/L	20	ND		02/27/95
Cesium-134	pCi/L	14	ND		02/27/95
Cesium-137	pCi/L	23	ND		02/27/95
Cesium-141	pCi/L	20	ND		02/27/95
Europium-152	pCi/L	41	ND		02/27/95
Europium-154	pCi/L	45	ND		02/27/95

Europium-155	pCi/L	56	ND		02/27/95
Bismuth-207	pCi/L	16	ND		02/27/95
Thallium-208	pCi/L	43	ND		02/27/95
Lead-210	pCi/L	2300	ND		02/27/95
Bismuth-210	pCi/L	153	ND		02/27/95
Lead-212	pCi/L	199	ND		02/27/95

Lead-214	pCi/L	24	ND		02/27/95
Bismuth-214	pCi/L	33	ND		02/27/95
Thorium-227	pCi/L	130	ND		02/27/95

REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
Page 4

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

PACE Sample Number:

65 0024415

Date Collected:

02/17/95

Time Collected:

12:15

Date Received:

02/18/95

Client Sample ID:

SCIOTO 002

Parameter

Units

MDL

METHOD DATE ANALYZED

INORGANIC ANALYSIS

GAMMA SCAN

EPA 901.1

Actinium-228

pCi/L

54

ND

02/27/95

Thorium-234

pCi/L

1200

ND

02/27/95

Protactinium-234

pCi/L

2700

ND

02/27/95

ISOTOPIC URANIUM

Uranium 234

pCi/L

0.68

ND

03/01/95

Uranium 235

pCi/L

0.21

ND

03/01/95

Uranium 238

pCi/L

0.55

ND

03/01/95

REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
Page 5

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

PACE Sample Number:
Date Collected:
Time Collected:
Date Received:
Client Sample ID:
Parameter

65 0024423
02/17/95
12:32
02/18/95
SCIOTO 003

Units MDL METHOD DATE ANALYZED

INORGANIC ANALYSIS

GROSS ALPHA AND BETA

Alpha, Gross	pCi/L	3.1	ND	EPA 900.1	03/02/95
Beta, Gross	pCi/L	6.1	26+-5.0		03/02/95

GAMMA SCAN

Sodium-22	pCi/L	28	ND	EPA 901.1	02/27/95
Potassium-40	pCi/L	290	ND		02/27/95
Manganese-54	pCi/L	13	ND		02/27/95
Cobalt-58	pCi/L	18	ND		02/27/95
Iron 59	pCi/L	51	ND		02/27/95
Cobalt-60	pCi/L	17	ND		02/27/95

Zinc-65	pCi/L	47	ND		02/27/95
Strontium-85	pCi/L	21	ND		02/27/95
Ruthenium-103	pCi/L	16	ND		02/27/95
Antimony-124	pCi/L	17	ND		02/27/95
Iodine-129	pCi/L	NC	NC		02/27/95
Iodine-131	pCi/L	30	ND		02/27/95

Barium-133	pCi/L	17	ND		02/27/95
Cesium-134	pCi/L	18	ND		02/27/95
Cesium-137	pCi/L	19	ND		02/27/95
Cesium-141	pCi/L	24	ND		02/27/95
Europium-152	pCi/L	35	ND		02/27/95
Europium-154	pCi/L	67	ND		02/27/95

Europium-155	pCi/L	60	ND		02/27/95
Bismuth-207	pCi/L	14	ND		02/27/95
Thallium-208	pCi/L	33	ND		02/27/95
Lead-210	pCi/L	2800	ND		02/27/95
Bismuth-210	pCi/L	16	ND		02/27/95
Lead-212	pCi/L	20	ND		02/27/95

Lead-214	pCi/L	30	ND		02/27/95
Bismuth-214	pCi/L	40	ND		02/27/95
Thorium-227	pCi/L	120	ND		02/27/95

REPORT OF LABORATORY ANALYSIS

Niel Ludtke

FOOTNOTES

March 03, 1995

for pages 1 through 6

PACE Project Number: D50218501

Reference: Scioto Ordnance

Method Detection Limit

Not detected at or above the MDL.

SCIOTO ORDNANCE

RADIOCHEMICAL ANALYTICAL QUALITY CONTROL

REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
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QUALITY CONTROL DATA

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

GAMMA SCAN

Batch: 65 23323
Samples: 65 0024407, 65 0024415, 65 0024423

METHOD BLANK AND SAMPLE DUPLICATE:

Parameter	Units	MDL	Method Blank	650024423 SCIOTO 003	Duplicate of 65 0024423	RPD
Sodium-22	pCi/L	12	ND			
Sodium-22	pCi/L	28		ND		
Sodium-22	pCi/L	24			ND	NC
Potassium-40	pCi/L	210	ND			
Potassium-40	pCi/L	290		ND		
Potassium-40	pCi/L	170			ND	NC
Manganese-54	pCi/L	16	ND			
Manganese-54	pCi/L	13		ND		
Manganese-54	pCi/L	18			ND	NC
Cobalt-58	pCi/L	14	ND			
Cobalt-58	pCi/L	18		ND		
Cobalt-58	pCi/L	15			ND	NC
Iron 59	pCi/L	44	ND			
Iron 59	pCi/L	51		ND		
Iron 59	pCi/L	59			ND	NC
Cobalt-60	pCi/L	16	ND			
Cobalt-60	pCi/L	17		ND		
Cobalt-60	pCi/L	20			ND	NC
Zinc-65	pCi/L	43	ND			
Zinc-65	pCi/L	47		ND		
Zinc-65	pCi/L	41			ND	NC
Strontium-85	pCi/L	21	ND	ND		
Strontium-85	pCi/L	20			ND	NC
Ruthenium-103	pCi/L	16	ND	ND		
Ruthenium-103	pCi/L	19			ND	NC
Antimony-124	pCi/L	14	ND			
Antimony-124	pCi/L	17		ND		
Antimony-124	pCi/L	18			ND	NC
Iodine-129	pCi/L	NA	NC			
Iodine-129	pCi/L	NC		NC	NC	
Iodine-131	pCi/L	14	ND			

Mr. Niel Ludtke
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QUALITY CONTROL DATA

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

GAMMA SCAN

Batch: 65 23323
Samples: 65 0024407, 65 0024415, 65 0024423

METHOD BLANK AND SAMPLE DUPLICATE:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>Method Blank</u>	650024423 <u>SCIOTO 003</u>	Duplicate of 65 0024423	<u>RPD</u>
Iodine-131	pCi/L	30		ND		
Iodine-131	pCi/L	35			ND	NC
Barium-133	pCi/L	15	ND			
Barium-133	pCi/L	17		ND		
Barium-133	pCi/L	15			ND	NC
Cesium-134	pCi/L	17	ND			
Cesium-134	pCi/L	18		ND		
Cesium-134	pCi/L	13			ND	NC
Cesium-137	pCi/L	14	ND			
Cesium-137	pCi/L	19		ND		
Cesium-137	pCi/L	18			ND	NC
Cesium-141	pCi/L	18	ND			
Cesium-141	pCi/L	24		ND		
Cesium-141	pCi/L	20			ND	NC
Europium-152	pCi/L	41	ND			
Europium-152	pCi/L	35		ND	ND	NC
Europium-154	pCi/L	33	ND			
Europium-154	pCi/L	67		ND		
Europium-154	pCi/L	53			ND	NC
Europium-155	pCi/L	56	ND			
Europium-155	pCi/L	60		ND		
Europium-155	pCi/L	57			ND	NC
Bismuth-207	pCi/L	17	ND			
Bismuth-207	pCi/L	14		ND		
Bismuth-207	pCi/L	13			ND	NC
Thallium-208	pCi/L	48	ND			
Thallium-208	pCi/L	33		ND		
Thallium-208	pCi/L	50			ND	NC
Lead-210	pCi/L	2700	ND			
Lead-210	pCi/L	2800		ND		
Lead-210	pCi/L	2700			ND	NC

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

GAMMA SCAN

Batch: 65 23323

Samples: 65 0024407, 65 0024415, 65 0024423

METHOD BLANK AND SAMPLE DUPLICATE:

Parameter	Units	MDL	Method Blank	650024423 SCIOTO 003	Duplicate of 65 0024423	RPD
Bismuth-210	pCi/L	15	ND			
Bismuth-210	pCi/L	16		ND		
Bismuth-210	pCi/L	18			ND	NC
Lead-212	pCi/L	23	ND			
Lead-212	pCi/L	20		ND	ND	NC
Lead-214	pCi/L	28	ND			
Lead-214	pCi/L	30		ND	ND	NC
Bismuth-214	pCi/L	30	ND			
Bismuth-214	pCi/L	40		ND		
Bismuth-214	pCi/L	30			ND	NC
Thorium-227	pCi/L	85	ND			
Thorium-227	pCi/L	120		ND		
Thorium-227	pCi/L	140			ND	NC
Actinium-228	pCi/L	54	ND	ND		
Actinium-228	pCi/L	60			ND	NC
Thorium-234	pCi/L	1000	ND			
Thorium-234	pCi/L	1100		ND	ND	NC
Protactinium-234	pCi/L	2400	ND			
Protactinium-234	pCi/L	2700		ND		
Protactinium-234	pCi/L	2000			ND	NC

LABORATORY CONTROL SAMPLE:

Parameter	Units	MDL	Reference Value	Recy
Cobalt-60	pCi/L	430	6681	94%
Cesium-137	pCi/L	370	4040	99%

REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
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QUALITY CONTROL DATA

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

GROSS ALPHA AND BETA

Batch: 65 23322
Samples: 65 0024407, 65 0024415, 65 0024423

METHOD BLANK:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>Method</u> <u>Blank</u>
Alpha, Gross	pCi/L	1.4	ND
Beta, Gross	pCi/L	4.8	ND

SPIKE AND SPIKE DUPLICATE:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	650024407 <u>SCIOTO 001</u>	<u>Spike</u>	<u>Spike</u> <u>Recv</u>	<u>Spike</u> <u>Dupl</u> <u>Recv</u>	<u>RPD</u>
Alpha, Gross	pCi/L	3.0	ND	65.9	70%		
Alpha, Gross	pCi/L	2.8		65.9		104%	39%
Beta, Gross	pCi/L	7.0	29+-5.7				
Beta, Gross	pCi/L	8.1		285			
Beta, Gross	pCi/L	7.1		285			

LABORATORY CONTROL SAMPLE:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>Reference</u> <u>Value</u>	<u>Recv</u>
Alpha, Gross	pCi/L	1.6	57.1	127%
Beta, Gross	pCi/L	4.9	247	128%

REPORT OF LABORATORY ANALYSIS

Mr. Niel Ludtke
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QUALITY CONTROL DATA

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

ISOTOPIC URANIUM

Batch: 65 23324

Samples: 65 0024407, 65 0024415, 65 0024423

METHOD BLANK:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>Method</u> <u>Blank</u>
Uranium 234	pCi/L	0.46	ND
Uranium 235	pCi/L	0.20	ND
Uranium 238	pCi/L	0.42	ND

SPIKE AND SPIKE DUPLICATE:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	650024407 <u>SCIOTO 001</u>	<u>Spike</u>	<u>Spike</u> <u>Recv</u>	<u>Spike</u> <u>Dupl</u> <u>Recv</u>	<u>RPD</u>
Uranium 238	pCi/L	0.47	ND				
Uranium 238	pCi/L	0.40		4.54	119%		
Uranium 238	pCi/L	0.34		4.54		131%	10%

LABORATORY CONTROL SAMPLE:

<u>Parameter</u>	<u>Units</u>	<u>MDL</u>	<u>Reference</u> <u>Value</u>	<u>Recv</u>
Uranium 238	pCi/L	0.34	4.54	82%

Mr. Niel Ludtke
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FOOTNOTES
for pages 8 through 12

March 03, 1995
PACE Project Number: D50218501

Client Reference: Scioto Ordnance

MDL	Method Detection Limit
NC	No calculation due to value below detection limit.
ND	Not detected at or above the MDL.
RPD	Relative Percent Difference

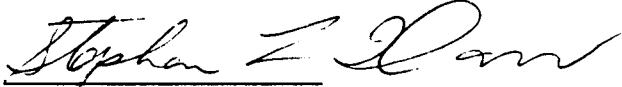
Appendix B

Site-specific Safety and Health Plan

HEALTH AND SAFETY PLAN

- Facility:** Former Scioto Ordnance Plant
- Location:** Marion County; northeast of Marion, Ohio
- Scope:** Work involved will include a radiological survey of approximately seven rooms using Ludlum Model 3 meters with alpha probes and beta/gamma probes. Additionally, up to six water samples will be collected from a basement which is flooded. The seven rooms and basement are located in a large warehouse on the site. The warehouse is currently in use for storage.
- Site History:** The building of concern was reportedly constructed in 1947-1948 and the Monsanto Corporation had a contract to investigate the best method of producing atomic energy. Monsanto used a small nuclear reactor to manufacture uranium in the building. Monsanto's method was not selected for further development, the contract was terminated, and the building was sold and gutted of copper and lead. Warner Warehousing has owned the Monsanto building since 1970; it currently occupies the old inert storage area of the ordnance plant which had been used by Monsanto.
- Potential Hazards:** Potential hazards include radiological contamination in the building. Additionally, physical hazards may exist as the building is in use for storage. These include: equipment such as fork lifts in use, tripping, etc. There is no reported chemical contamination at the site.
- Rad Survey:** Two SAIC field team members will be accompanied by three COE personnel during the survey. The survey will consist of scanning the walls and other likely areas of radiological contamination in each room. A room survey will be terminated if radiological contamination is encountered and the room will be vacated.
- Water Samples:** Up to six water samples will be collected from a flooded basement in the warehouse building. These samples will be collected by submerging the sample container directly into the water. It is believed that the basement water is accessible by stairs going into the basement.
- Hazard Control:** The following hazard controls will be used during this survey:
1. Monitoring with radiological meters will be used upon entering each room.

2. Rooms will be vacated immediately if rad meter readings above the established action level are obtained.
3. All building restrictions and safety regulations will be followed.
4. SAIC Corporate Health and Safety Program as contained in the SAIC Corporate EC&HS manual will be followed.
5. Disposable gloves will be worn when collecting water samples. Disposable gloves and boot covers will be available for use during the rad surveys, if necessary.
6. Hands and bottom of shoes will be surveyed with rad meters before leaving any room in which radiological contamination was detected.

Approved: 
Steve Davis
Corporate Health and Safety Officer

Appendix C

Certificates of Calibration



CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

POST OFFICE BOX 810

PH. 915-235-5404

501 OAK STREET

FAX NO. (915) 235-4872

SWEETWATER, TEXAS 79558, U. S. A.

CUSTOMER Sax ORDER NO. 208422
Mfg. Ludlum Model 3 Serial No. 104696
Mfg. Ludlum Det. Model 43-5 Serial No. PR100995
Cal. Date 9-26-94 Cal. Due Date 9-26-95 Cal. Interval 14R METERFACE 002
Check mark (✓) applies to applicable Instr. and/or detector IAW mfg. spec. T 71 °F RH 39 % Alt 705.8 mm Hg
☒ F/S Resp. ck ☒ Reset ck ☒ Audio ck ☒ Meter Zeroed ☐ Window Operation ☐ Background subtract
☐ Alarm Setting ck ☒ Mechanical ck ☒ Bat. ck. (Min. Volt) 2.2 VDC Det. Oper. V 750 / at 36 MV
Instrument Volt Set 750 V Threshold Dial _____ Input Sens 36 mV. ☐ Input Sens Linearity
☐ New Instrument Instrument Received: ☒ Within Toler. + -10% ☐ 10-20% ☐ Out Toler. ☒ Requiring Repair
☐ HV Readout (2 points) Ref./Inst. _____ / _____ V Ref./Inst. _____ / _____ V

COMMENTS: Calibrated according to Lmd Sop 14.8 revision 12-5-89
PO# 6213063

Gamma Calibration: GM detectors positioned perpendicular to source except for M. 44-0 in which the front of probe faces source.

RANGE MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT METER READING *	INSTRUMENT REC'D "AS FOUND READING"
X <u>100</u>	<u>400 kcpm</u>	<u>4K</u>	<u>4K</u>
X <u>"</u>	<u>100 "</u>	<u>1K</u>	<u>1K</u>
X <u>10</u>	<u>40 "</u>	<u>4K</u>	<u>4K</u>
X <u>"</u>	<u>10 "</u>	<u>1K</u>	<u>1K</u>
X <u>1</u>	<u>4 "</u>	<u>4K</u>	<u>4K</u>
X <u>"</u>	<u>1 "</u>	<u>1.05K</u>	<u>1.05K</u>
X <u>0.1</u>	<u>400 cpm</u>	<u>4K</u>	<u>4K</u>
X <u>"</u>	<u>100 "</u>	<u>1K</u>	<u>1K</u>
X _____	_____	_____	_____
X _____	_____	_____	_____
X _____	_____	_____	_____

*Uncertainty within + -10%

C. F. within + -30%

all

Range(s) Calibrated Electronically

Reference Cal. Point

Instrument Meter Reading

"As Found Reading"

Digital Readout

Log Scale

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration technique. The calibration system conforms to the requirements of MIL-STD-45662A and ANSI N323-1978

☐ Cs137 Gamma s/n 1162, G112, M565,5105, 5604, T879 ☐ Neutron Am-241 Be s/n T-304 State of Texas Calibration License No. LO-1988

☐ Alpha s/n _____ ☐ Beta s/n _____ ☐ Other _____

☒ M-500 s/n 50800 ☐ Oscilloscope s/n _____ ☒ Multimeter s/n A25832

Calibrated By: Connie Tomlinson Date 9-26-94

Reviewed By: Jimmi Fleming Date 9-26-94



CERTIFICATE OF CALIBRATION

LUDLUM MEASUREMENTS, INC.

POST OFFICE BOX 810

PH. 915-235-8484

501 OAK STREET

FAX NO. (915) 235-4672

SWEETWATER, TEXAS 79556, U. S. A.

CUSTOMER Boic ORDER NO. 205256
 Mfg. Ludlum Model 3 Serial No. 100956
 Mfg. Ludlum Det. Model 44-9 Serial No. PR100209
 Cal. Date 4-4-94 Cal. Due Date 4-4-95 Cal. Interval 146 METERFACE 608
 Check mark (☒) applies to applicable Instr. and/or detector IAW mfg. spec. T. 73 °F RH 20 % Alt 702.8 mm Hg
☒ F/S Resp. ck ☒ Reset ck. ☒ Audio ck. ☒ Meter Zeroed ☐ Window Operation ☐ Background subtract
☐ Alarm Setting ck. ☒ Mechanical ck. ☒ Bat. ck. (Min. Volt) 2.2 VDC Det. Oper. V 900 at 33 MV
 Instrument Volt Set 900 V Threshold Dial _____ Input Sens 33 mV. ☐ Input Sens Linearity
☐ New Instrument Instrument Received: ☐ Within Toler. + -10% ☐ 10-20% ☐ Out Toler. ☒ Requiring Repair
☐ HV Readout (2 points) Ref./Inst. _____ / _____ V Ref./Inst. _____ / _____ V

COMMENTS: Calibrated according to Lmd SOP 4.9 revision
12/5/89

PC# 6107971

Gamma Calibration: GM detectors positioned perpendicular to source except for M. 44-9 in which the front of probe faces source.

RANGE MULTIPLIER	REFERENCE CAL. POINT	INSTRUMENT METER READING *	INSTRUMENT REC'D "AS FOUND READING"
X <u>100</u>	<u>150 mR/hr</u>	<u>1.5</u>	
X <u>"</u>	<u>50 "</u>	<u>0.51</u>	
X <u>10</u>	<u>15 "</u>	<u>1.5</u>	
X <u>"</u>	<u>5 "</u>	<u>0.55</u>	
X <u>1</u>	<u>1.5" = 4590 cpm</u>	<u>1.5</u>	
X <u>"</u>	<u>1 mR/hr</u>	<u>1.0</u>	<u>N/A</u>
X <u>0.1</u>	<u>459 cpm</u>	<u>1.5</u>	
X <u>"</u>	<u>153 "</u>	<u>0.5</u>	
X			
X			
X			

*Uncertainty within + -10%

C. F. within + -20%

10.1

Range(s) Calibrated Electronically

Reference Cal. Point

Instrument Meter Reading

"As Found Reading"

Digital Readout / / / / / / / / / / / / / / /
 Log Scale / / / / / / / / / / / / / / /

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration technique. The calibration system conforms to the requirements of MIL-STD-4561A and ANSI N33-1976

☒ Cs137 Gamma s/n 1162, G112, M565, 5105, 5604, T879 ☐ Neutron Am-241 Be s/n T-304 State of Texas Calibration License No. LO-1963

☐ Alpha s/n _____ ☐ Beta s/n _____ ☐ Other _____

☒ M-500 s/n 101499 ☐ Oscilloscope s/n _____ ☒ Multimeter s/n A25832

Calibrated By: Connie Jordan Date 4-4-94

Reviewed By: Gimmie Fleming Date 4-7-94

CERTIFICATE OF INSTRUMENT CALIBRATION

CUSTOMER INFORMATION

SAIC

INSTRUMENT INFORMATION

Make Ludlum Model # 3 Serial # 107143

Probe Type Ludlum Model # 43-5 Serial # 107040

CALIBRATION DATA

Electronic ☒ Source ☐ Efficiency ☒ As Found HV 650V

Plateau Determined ☐ yes ☒ no HV at Calibration 650V Pulse size 80mV

Scale	Electronic			Source			Efficiency	
	Input CPM	As Found	Left	Field mR/hr	As Found	Left	α	$\beta \gamma$
X0.1	250	250	250				Toe <u>1000</u>	Inst. cpm <u> </u>
"	100	100	100				Center <u>1000</u>	Bkg. cpm <u> </u>
"	400	400	400				Heal <u>1000</u>	Corrected cpm <u> </u>
X1	2.5K	2.5K	2.5K				Avg (cpm) <u>1000</u>	
"	1K	1K	1K				Bkg (cpm) <u>1</u>	Actual dpm \div <u> </u>
"	4K	4K	4K				Corrected cpm <u>999</u>	
X10	25K	25K	25K				Actual dpm \div <u>10,500</u>	
"	10K	10K	10K				Efficiency (%) <u>9.5</u>	
"	40K	40K	40K				$10.51 \times \text{Corrected cpm} = \text{DPM}$	
X100	250K	250K	250K				Source ID <u>307</u>	
"	100K	100K	100K				Isotope <u>Th 230</u>	
"	400K	400K	400K				Geometry <u>2π</u> <u>4π</u>	
							Uncertainty <u>5%</u>	

Pulser Make <u>Ludlum</u>	Source ID <u> </u>
Model Number <u>500</u>	Isotope <u> </u>
Serial Number <u>32797</u>	Activity <u> </u>
Calibration Date <u>9-20-94</u>	

SOURCES AND INSTRUMENTS USED IN THE CALIBRATION OF THIS INSTRUMENT ARE TRACEABLE TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY THROUGH PRIMARY OR SECONDARY STANDARDS.

Calibrated by Joel A. Isham Joel A. Isham 11/7/94
 Name Signature Date

Calibration Due 11/7/95 Reviewed by Joel A. Isham

